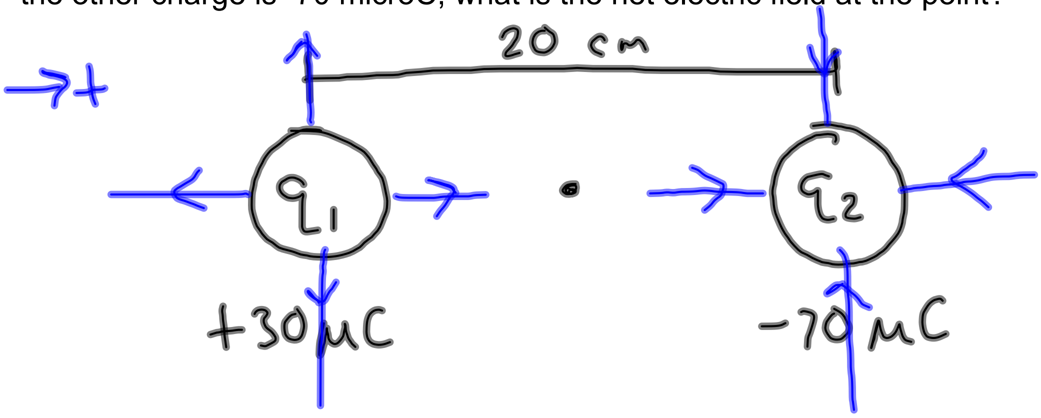
Circuit Notes 4th Block 11.10.11

Two charges are separated by a distance of 20 cm, and there is a point halfway between them at which we want to measure the electric field. If one charge is +30 microC and the other charge is -70 microC, what is the net electric field at the point?



$$\Sigma \bar{E} = \bar{E}_1 + \bar{E}_2$$

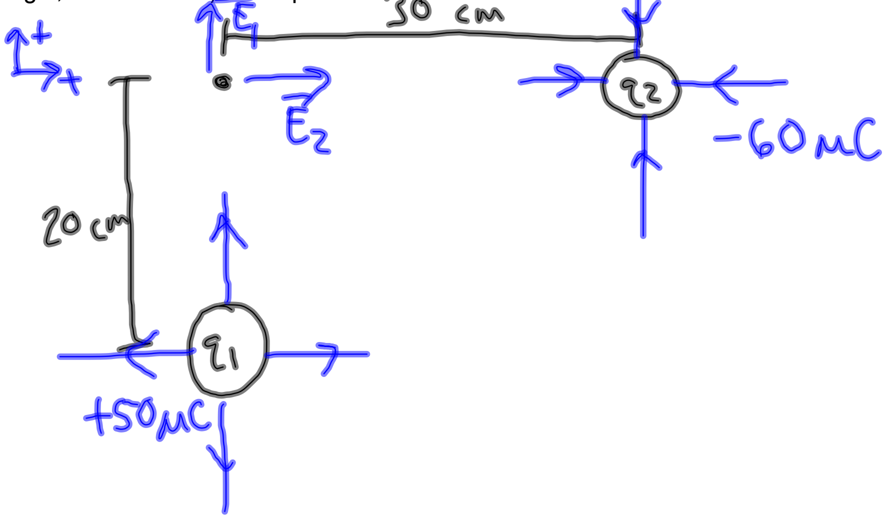
$$= +\frac{k|q_1|}{r_1^2} + \frac{k|q_2|}{r_2^2}$$

$$= (8.99E9\ N\cdot m^2/C^2)\left[\frac{30E\text{-}6\,C}{(.1\,m)^2} + \frac{70E\text{-}6\,C}{(.1\,m)^2}\right]$$

$$= 8.99E7\ N/C$$

Circuit Notes 4th Block 11.10.11

Two charges are arranged with a point in a right triangle. Charge 1 has a value of +50 microC, and charge 2 has a value of -60 microC. Find the net electric field (magnitude, angle, and direction) at the point.



$$\Sigma \bar{E}_x = \bar{E}_{1x}^{\;0} + \bar{E}_{2x}$$

$$= \frac{k|q_2|}{r_2^2} = \frac{(8.99E9\ N\cdot m^2/C^2)(60E\text{-}6\ C)}{(.3\ m)^2}$$

$$= 6.0E6\ N/C$$

$$\Sigma \bar{E}_y = \bar{E}_{1y} + \bar{E}_{2y}^{\;\emptyset}$$

$$= \frac{k|q_1|}{r_1^2} = \frac{(8.99E9\ N\cdot m^2/C^2)(50E\text{-}6\ C)}{(.2\ m)^2}$$

$$= 1.1E7\ N/C$$

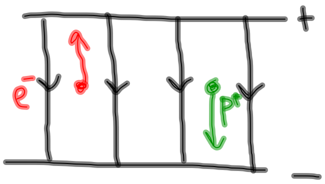
$E = 1.27E7\ N/C$

$\theta = 62°$

N of E

An electron and a proton are each placed at rest in an external uniform electric field of magnitude 520 N/C. Calculate the speed of each particle after 48 ns.

* ignore gravity



$V_f = ?$

$V_i = \varnothing\ m/s$ $\quad E = 520\ N/C$

$t = 42E{-}9\ s$ $\quad |q_e| = |q_p| = 1.6E{-}19\ C$

$M_e = 9.109E{-}31\ kg$ $\quad M_p = 1.673E{-}27\ kg$

for e^-:

$V_f = V_i^{\nearrow \varnothing} + at$ $\qquad \Sigma \bar{F} = m_e \bar{a}$

$a = \frac{\Sigma F}{m_e} = \frac{F_e}{m_e} = \frac{q_e E}{m_e}$

$\bar{E} = \frac{\bar{F}_e}{q_e}$

$\bar{F}_e = q_e \bar{E}$

$V_f = \frac{q_e E t}{m_e}$

$= \frac{(1.6E{-}19\ C)(520\ N/C)(48E{-}9\ s)}{(9.109E{-}31\ kg)}$

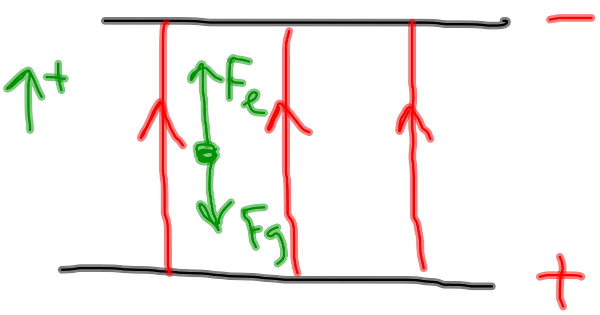
$= 4.38E6\ m/s$

for p^+: $V_f = \frac{q_p E t}{m_p}$

$= 2387\ m/s$

Circuit Notes 4th Block 11.10.11

An object with a net charge of 24 microC is placed in a uniform electric field of 610 N/C, directed vertically. What is the mass of this object if it floats in this electric field?



$$\Sigma F = \emptyset$$

$$F_e - F_g = \emptyset$$

$$F_e = F_g \qquad F_g = m a_g$$

$$qE = m a_g \qquad F_e = qE$$

$$m = \frac{qE}{a_g}$$

$$= \frac{(24E\text{-}6\ C)(610\ N/C)}{(9.8\ m/s^2)}$$

$$= 1.49E\text{-}3\ kg$$

- Current
  - flow of e^-
  - $I = \frac{\Delta q}{\Delta t}$ → change in charge (Δq); → change in time (Δt)
    - ↳ current (I)
  - Units 1 Ampere (A) = $1 \frac{C}{s}$
    (Amp)
  - We measure with an ammeter.

- Resistance
  - Amount that material impedes the flow of e^-.
  - measured in Ohms (Ω).
    capital omega

- Ohm's Law:

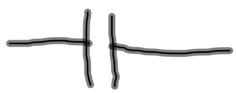
$$V = IR$$

→ resistance (R)
↳ current (I)
↳ voltage (V)

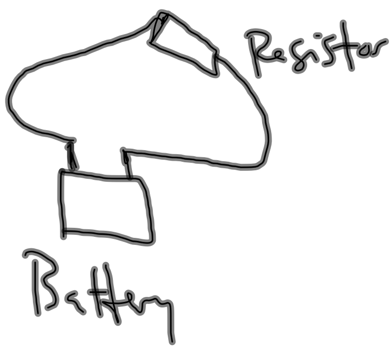
$$1\,\Omega = 1\,\frac{V}{A}$$

Circuits:

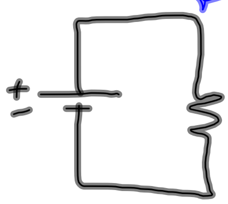
- Common pieces

Piece	Schematic representation
Wire	
Battery	
Resistor	
Capacitor	

- Schematics represent actual connections.



Physical

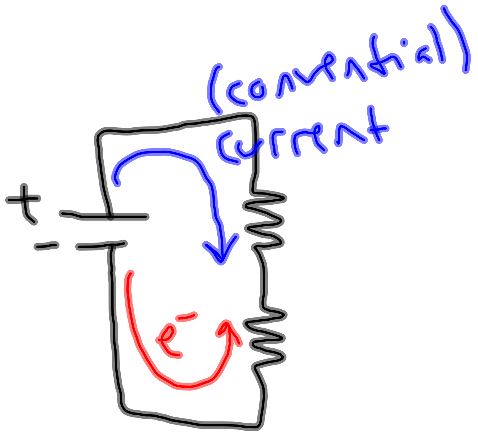


{draw right angles

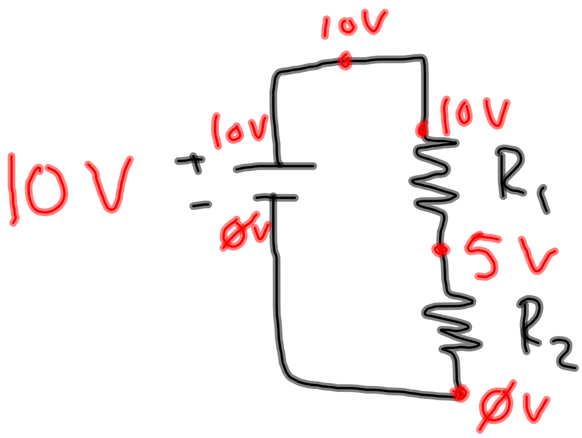
Schematic

• Ways to Connect Pieces:

1. Series



- pieces connected back-to-back
- e^- only have one path



} voltage drop

$R_1 = R_2$

} voltage drop

Current is equal in all parts of the circuit.